FINAL STATUS REPORT

for

NASA Grant NAGW-2582

April 20, 1995

"Analysis of Stratospheric Trace Gas Satellite Measurements"

J. L. Stanford, Principal Investigator

GRANT OBJECTIVES:

The stratospheric trace gas constituents methane (CH_4) and nitrous oxide (N_2O) are important greenhouse gases and links in the chain leading to ozone depletion. Moreover, as long-lived tracers of stratospheric circulation, knowledge of their distribution and transport provides critical assessment of global stratospheric circulation models. The objectives of this grant are to determine the three-dimensional and temporal variability of satellite-derived global measurements of methane and nitrous oxide from three years of Stratospheric and Mesospheric Sounder (SAMS) data fields, and to use these in dynamical calculations to determine the circulation in the stratosphere and lower mesosphere.

Stratospheric and Mesospheric Sounder (SAMS) CH_4 and N_2O constituent measurements were taken a decade prior to the Upper Atmosphere Research Satellite (UARS) observations and are generally of lesser quality. However, SAMS data are important due to the limited lifetime of UARS and because they provide unique, historical data series for these gases involved in greenhouse and ozone-depletion effects.

SUMMARY OF ACTIVITIES:

Stratospheric circulation dynamics have been investigated using 3 years of zonal mean SAMS nitrous oxide and methane data fields. Pulses of constituent concentration are observed to exhibit seasonal upwelling and latitudinal propagation from low latitudes towards the poles. Both "effective transport" and Transformed Eulerian Mean formulations were used. The former employed a novel calculational technique to derive both the zonal mean transport velocity components as well as the eddy diffusion tensor as a function of time, height and latitude (Stanford, et al., 1993).

We also investigated zonal asymmetries (planetary scale waves) in SAMS constituent data. Our results indicate that with careful data preprocessing and analysis it is possible to isolate large waves in SAMS stratospheric constituents. The first observational

investigation of the spatial and temporal variation of such waves in nitrous oxide and methane is reported in Gao and Stanford (1993). This work describes zonal wave one (one wavelength fits around a latitude circle) perturbations with periods of a few weeks in the upper stratosphere. Further analyses of zonal asymmetries in SAMS data are investigated in Ziemke and Stanford (1995). The latter assesses the strengths and weaknesses of analyzing wave-like features in SAMS, including model simulation of aliasing due to the irregular sampling inherent in the data.

We appreciate the funds provided under this grant. Several bright young scientists have received training as a result of this grant and are, and will be, contributing to climate research.

PAPERS CITED

Stanford, J. L., J. R. Ziemke and S. Y. Gao, 1993: Stratospheric Circulation Features Deduced from SAMS Constituent Data. J. Atmos. Sci., 50, 226-246.

Gao, H., and J. L. Stanford, 1993: Time-varying Zonal Asymmetries in Stratospheric N_2O and CH_4. Quart. J. Royal Meteor. Soc., London, 119, 591-598.

Ziemke, J. R., and J. L. Stanford, 1995: Zonal Asymmetries in SAMS Stratospheric Methane and Nitrous Oxide. Quart. J. Roy. Meteor. Soc., London (in press).

Stone, E. M., J. L. Stanford, J. R. Ziemke, F. W. Taylor(1), C. D. Rodgers(1), and B. N. Lawrence(1), E. F. Fishbein(2), L. S. Elson(2) and J. W. Waters(2), 1995. Space-time integrity of ISAMS and MLS temperature fields at Kelvin wave scales. J. Geophys. Res. (in press).

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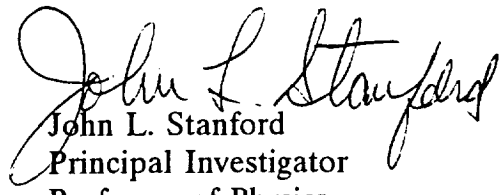

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